MULTIMEDIA UNIVERSITY

STUDENT IDENTIFICATION NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

BDE 2014 – DIFFERENTIAL EQUATIONS

(All Sections / Groups)

29 May 2017
9.00 a.m. – 11 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 2 pages.
2. Attempt all 4 questions. The distribution of marks for each question is given.
3. Students are allowed to use scientific calculators.
4. Please write your answers in the **Answer Booklet** provided.

Question 1 [Total = 25 marks]

a) Solve the following non-linear differential equation using the separable equation method:

$$\frac{dy}{dx} = \frac{6x^5 - 2x + 1}{\cos y + e^y}$$

[6 marks]

b) For the following differential equation:

$$y + 2x + x\frac{dy}{dx} = 0$$

(i) Show that the differential equation (DE) is exact.
(ii) Find the solution to the exact DE.

[9 marks]

c) Consider the following differential equation (DE):

$$x\frac{dy}{dx} + 4y = 2x^3 - x^2$$

(i) Rewrite the DE in the form of $\frac{dy}{dx} + p(x)y = r(x)$.
(ii) From (i), find its integrating factor.
(iii) Hence, find the general solution of the DE.

[10 marks]

Question 2 [Total = 25 marks]

a) Solve the following initial value problem:

$$y''+2y'+y = 0 \quad ; \quad y(0) = 5 \; ; \; y'(0) = -3$$

[10 marks]

b) For the following differential equation(DE), solve the DE using undetermined coefficients- superposition approach:

$$y''+4y'+3y = 5\cos(x)$$

(i) Find the complementary function, y_h of the above DE.
(ii) Find the particular function, y_p of the above DE.
(iii) Find the general equation, y of the above DE.

[15 marks]

Continued...

Question 3 [Total = 25 marks]

a) Over a period of 1 year, the price P of a certain commodity follows the model $150P''+15P'-9P=0$ where P is in dollars per pound and t is in months. Assume that $P(0)=16$ and $\frac{dP}{dt}(0)=2.7$. Find the particular solution P.

[11 marks]

b) Find the general solution for the following non-homogenous Cauchy-Euler equation by using variation of parameters method:

$$x^2y''-4xy'+6y=2x^3$$

[14 marks]

Question 4 [Total = 25 marks]

a) Classify the following partial differential equations as hyperbolic, parabolic, or elliptic.

(i) $\mu_{xx}+4\mu_{xy}+4\mu_{yy}+\mu_x-2\mu_y=0$

(ii) $\mu_{xy}-\mu_{yy}-3\mu_x=5$

(iii) $-2\mu_{xx}-\mu_{yy}+6\mu_y=9$

[9 marks]

b) Find the partial differential equation by eliminating the arbitrary constants from the

$$z=4x^2+(y+b)^3$$

[7 marks]

c) Solve the following partial differential equation

$$\frac{\partial^2 z(x,y)}{\partial x^2}-3\frac{\partial z(x,y)}{\partial x}-4z(x,y)$$

subject to the condition x=0, and $\frac{\partial z}{\partial x}=-2$ and $\frac{\partial z}{\partial y}=1$

[9 marks]

End of paper